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**Spatial Data Transfer Standard (SDTS)
Topological Vector Profile (TVP) Validation Procedures
Part of United States Geological Survey
Recognition of Spatial Data Transfer Standard (SDTS)
Topological Vector Profile (TVP)
Certification System**

Prepared by:
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Prepared for:
United States Geological Survey
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Reston, Virginia 22092

U.S. DEPARTMENT OF COMMERCE
Technology Administration
National Institute of Standards
and Technology
Gaithersburg, MD 20899-0001



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U.S. DEPARTMENT OF COMMERCE
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for Technology

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AND TECHNOLOGY
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United States Geological Survey Certification System Documents

The Model for United States Geological Survey Recognition of Spatial Data Transfer Standard (SDTS) Topological Vector Profile (TVP) Certification System includes a total of five (5) documents which are enumerated below:

1. Overview of Model for United States Geological Survey Recognition of Spatial Data Transfer Standard (SDTS) Topological Vector Profile (TVP) Certification System.
2. Model for Test Method Executive Control Committee (TMECC) Organization and Procedures Part of United States Geological Survey Recognition of Spatial Data Transfer Standard (SDTS) Topological Vector Profile (TVP) Certification System.
3. Criteria for United States Geological Survey (USGS) Recognizing Certificate Issuing Organizations Activities and Requirements Part of United States Geological Survey Recognition of Spatial Data Transfer Standard (SDTS) Topological Vector Profile (TVP) Certification System.
4. Criteria for United States Geological Survey (USGS) Recognizing Testing Laboratory/ies Activities and Requirements Part of United States Geological Survey Recognition of Spatial Data Transfer Standard (SDTS) Topological Vector Profile (TVP) Certification System.
5. Spatial Data Transfer Standard (SDTS) Topological Vector Profile (TVP) Validation Procedures Part of United States Geological Survey Recognition of Spatial Data Transfer Standard (SDTS) Topological Vector Profile (TVP) Certification System

1. Purpose

This document provides operating policy and procedures that are followed in administering the U.S. Geological Survey validation program for assessing conformance of products to the Spatial Data Transfer Standard (SDTS), Federal Information Processing Standard Publication 173.

2. Background

The Spatial Data Transfer Standard (SDTS), Federal Information Processing Standard Publication 173, is a standard which supports the exchange of spatial data between dissimilar computer systems. SDTS attempts to support any type of spatial data including raster, topological vector, network vector, and geometry-only vector. Due to the very many options supported in the SDTS it is impractical to implement the entire SDTS in one piece. Therefore, SDTS is being implemented in limited subsets called profiles. Profiles often are limited to a particular data type and significantly reduce the options allowed.

The Topological Vector Profile (TVP), Part 4 of the SDTS, limits the SDTS implementation to vector objects which contain full area topology. Many Federal agencies and geographic information systems (GIS) customers use this topological data model.

SDTS conformance testing tests for conformance to a specific SDTS profile, in this case the TVP. There are three types of products, which are tested in TVP conformance testing: **transfers, encoders, and decoders.**

- **Transfers** are the SDTS data sets, which are used to exchange data between different computer systems. TVP transfer conformance testing consists of testing specific transfers using automated and non-automated techniques. Only the specific transfers which is tested is certified as being conforming, transfer testing does not certify that other transfers created with the same encoder are conforming.
- **Encoders** are translators, which translate from a particular data format and computer system into the TVP. TVP encoder conformance testing consists of the Validation Customer demonstrating the encoder on three or more data sets, which exhibit the TVP options supported, by the encoder. The resulting TVP transfers are validated using the

same techniques as the transfer conformance testing. The input and output data sets are examined for possible loss or corruption of data.

- **Decoders** are translators, which translated from the TVP into a particular data format and computer system. Decoder conformance testing consists of the Validation Customer demonstrating the decoding of a set of transfers, which contain various TVP options.

3. Definitions

The following definitions apply only to the document series on the United States Geological Survey Recognition of Spatial Data Transfer Standard (SDTS) Topological Vector Profile (TVP) Certification System.

Certificate Issuing Organization (CIO): An impartial body with the primary responsibility of issuing certificates of validation for computer software when that software meets all requirements for certification.

Certification System: [ISO/IEC Guide 2] A system having its own rules of procedure and management for carrying out conformity certifications.

Conformance, conformity: [ISO/IEC Guide 2] Fulfillment by a product, process or service of all requirements specified.

Federal Information Processing Standards (FIPS) 173: This standard provides specifications (developed through the U.S. Department of the Interior and the United States Geological Survey) for the organization and structure of digital spatial data transfer, definition of spatial features and attributes, and data transfer encoding and decoding.

Information Technology (IT): means any equipment or interconnected system or subsystem of equipment, that is used in the automatic acquisition, storage, manipulation, management, movement, control, display, switching, interchange, transmission, or reception of data or information. The term "information technology" includes computer, ancillary equipment, software, firmware, and similar procedures, services (including support services), and related resources.

Non-conformity: [ISO/IEC Guide 2] The lack of fulfillment by a product, process or service of all requirements specified.

Testing Laboratory: [ISO/IEC Guide 2] A body recognized by the CIO that carries out the procedures required to determine the conformance of a software implementation to a standard.

Sponsoring Organization: [ISO/IEC Guide 25, ISO/IEC Guide 28] An organization which plays a key role in establishing or maintaining a conformance testing or certification program for assessing implementations for conformance to a standard. This may be any source which assumes responsibility for insuring the primary components of a Certification System (i.e., Test Suite, testing procedures, and product certification procedures) for a standard are in place. This source may be composed of one or more organizations.

Test Method: [ISO/IEC Guide 2] A defined technical procedure to determine one or more specified characteristics of a product.

Test Method Executive Control Committee (TMECC): A group of subject experts which provides guidance to the conformity assessment process for the purpose of maintaining integrity of the conformance process with regard to the standard(s) being tested.

Test Suite: [ISO/IEC Guide 2] The Test Suite is a systematic collection of tests designed to verify that a software product correctly supports all required features specified by the USGS SDTS/TVP standard. The Test Suite is not designed to replace the Validation Customer's quality assurance testing or systematically to detect inconsistencies or "bugs."

Validation: [ISO/IEC Guide 2] process of accomplishing the activities necessary to determine the conformance of an implementation to an Information Technology standard.

Validation testing: [ISO/IEC Guide 2] consists of a third party reviewing the Validation Customer's products, witnessing the running of the conformance tests, evaluating the test results, and reporting the results of that testing in a Validation Summary Report (VSR).

Validation Certificate: A certificate issued by authority of the CIO for a tested software product which meets all conformance requirements as specified by the TMECC.

Validation Customer: An individual or corporate confederation who enters into an agreement with a Testing Laboratory that specifies the terms and conditions for Testing Laboratory services (of any kind) to be performed.

Validation Issue: Any problem arising during a validation effort.

Validation Summary Report (VSR): A report produced by a Testing Laboratory containing the results that are observed from witness testing a specific software under test. Under the USGS requirements, a VSR indicating zero non-conformities supports the issuance of a Validation Certificate.

4. SDTS/TVP Recognized Certificate Issuing Organization

The U.S. Geological Survey maintains a list of recognized SDTS/TVP Certificate Issuing Organizations (which in turn recognize Testing Laboratories, which actually carries out the procedures required to establish the compliance of a software implementation to a standard). For information on this service, contact the U.S. Geological Survey by mail at:

U.S. Geological Survey
560 National Center
Reston, Virginia 22092

or via the Internet at: <http://mcmcweb.er.usgs.gov/sdts/index.html>

The U.S. Geological Survey recognized CIOs will provide the SDTS/TVP test suite.

5. SDTS/TVP Certification System

The SDTS/TVP Certification System consists of the TMECC, and the SDTS/TVP recognized CIO(s).

The TMECC provides validation guidance, interprets and maintains the SDTS/TVP standard, reviews all disputes regarding the SDTS/TVP Test Suite, sets validation standards to be followed by all recognized CIO(s) and Test Laboratory/ies, establishes the conditions for the issuance, the life, and the scope of a Validation Certificate, establishes the schedule for issuing versions of the SDTS/TVP Test Suite, resolves issues that may arise during validation when these issues cannot be resolved through the best efforts of the CIO and the Testing Laboratory, deciding on the withdrawal of test programs from the SDTS/TVP and directing the recognized CIO(s) to effect the test withdrawal from the SDTS/TVP

The CIO maintains current operating agreements with the CIO recognized Testing Laboratory/ies, issues the SDTS/TVP Validation Certificates, maintains a public list of CIO validated products, effects the TMECC withdrawal of tests from the SDTS/TVP Test Suite, and reviews all Validation Summary Reports (VSRs).

6. Test Dispute and Resolution Process

A "Validation Issue" is defined as a problem arising during a validation effort. An example of a Validation Issue may be any result from processing a Test Suite test program that is not a passed, inapplicable, or unsupported result according to the TMECC established grading criteria. Another example of a Validation Issue may be a CIO interpretation of the Validation Procedures. This intentionally broad definition of a "Validation Issue" is to make certain that all relevant issues are brought to the attention of the CIO via the Testing Laboratory, without assuming that such results would be accepted without special review. The Validation Customer also provides a rationale for each Validation Issue being made. The Testing Laboratory on behalf of their Validation Customer forwards validation Issues to the CIO, usually electronically.

On receipt of a Validation Issue, the CIO checks whether the Validation Issue has been previously resolved. If the issue is new, the CIO forwards it to the TMECC for review and resolution. The TMECC will review and resolve the Validation Issue using the USGS SDTS/TVP standard, references to previous issue deliberations, test requirements, the Validation Procedures or other appropriate references.

Deliberation of the issue proceeds with the exchange of each TMECC member's opinion and analysis. The CIO participates in the deliberation by providing information as requested (e.g., Test Suite tests or information from the petitioner), eliciting discussion from the TMECC members, and making or challenging points raised in the discussion.

For each issue that is accepted (i.e., when the TMECC rules in favor of the issue), it is likely that some correction is indicated. For example the TMECC could require the withdrawal any test that is found to be incorrect to a degree that makes it unsuitable for validation. The withdrawal of a test consists of including it on a list of tests that are ignored for validations conducted with the current Test Suite version. The TMECC requires that all USGS Recognized CIO(s) update the list of withdrawn tests, and that the CIO(s) distributes this list to the CIO recognized Testing Laboratory/ies. Withdrawn tests will be listed in the VSRs.

If a Validation Issue is related to the SDTS/TVP Standard and it not resolved by the TMECC, it may be submitted for formal interpretation to the SDTS/TVP Standards Committee. If formal interpretation is requested from the SDTS/TVP standards committee, the submitting CIO must receive a copy of the request for interpretation and other relevant correspondence.

See Appendix A for the Validation Customer Dispute Format.

7. Caveats

Validation testing does not warrant that the products tested are free of nonconformities, even if all tests in the test suite are passed. The determination of conformity to SDTS/TVP is based on results from testing using the latest version of the SDTS/TVP Test Suite. The practical goal of the SDTS/TVP validation is to identify SDTS/TVP products, which are in conformance to the FIPS 173.

8. SDTS/TVP Validation Testing

Validation testing consists of a third party reviewing the Validation Customer's products, witnessing the running of the conformance tests, evaluating the test results, and reporting the results of that testing in a Validation Summary Report (VSR).

If a product meets all validation procedure and all test suite conformance requirements, then a Validation Certificate and a Validation Summary Report (VSR) are issued; else only the VSR is issued.

9. Validation Summary Report (VSR)

The results of the validation testing are documented in a VSR. The product is described sufficiently to allow a procuring activity to identify the product and be able to purchase it without seeking additional information outside of the VSR. The VSR also contains:

- a. a table showing the pass/fail results for each SDTS profile and for each of the three (3) types of products which are tested in the TVP profile conformance testing: **Transfers, Encoders, and Decoders.**
- b. a description of any product options used during the validation testing process.
- c. documentation of any changes made to the test suite and why those changes were made.
- d. an analysis of all failed tests (if any).
- e. a description of test results for informational tests.
- f. inclusion of a Validation Customer Declaration of Conformance

To complete the VSR, the Validation Customer is asked to complete the Declaration of Conformance which is the Validation Customer's description of the testing environment (hardware and software) and it is the Validation Customer's assurance that the product(s) under test have no deliberate deviations from the SDTS/TVP Standard.

See Appendix B for a suggested Sample Validation Customer Declaration of Conformance.

10. Products with Certificates

A Validation Certificate is issued if all of the conformance requirements are met. The Validation Certificate identifies the IUT, the version of the test suite, which of the three (3) TVP products being tested (more than one may be included), the date of the beginning of the on-site witness validation testing, the Validation Certificate expiration date, the name of the CIO, the address and contact information for the CIO, the VSR identification number, the test suite identification, and the Standard against which conformance is being assessed (For SDTS, FIPS 173).

See Appendix C for a suggested Sample Validation Certificate Format.

11. Validation with Superseded Versions of the Test Suite

A product may validated with a superseded version of the Test Suite provided that such validation is marked prominently and boldly about this fact in the VSR and in any communication concerning the validation effort. Validation Certificates are not issued for validations using superseded versions of the Test Suite. This technical service may be needed to satisfy the validation wording of a particular procurement.

12. Requests for Validation

A request for the validation of a product purporting to support the FIPS 173 shall be sent to one of the Recognized Testing Laboratories found via Section 4.

The following information should be provided:

- a. Desired and alternate month(s) of testing;
- b. Product identification (fully identified with product number(s) and versions and/or releases, etc.);
- c. Technical point of contact for the validation (the technical person who is to help with the on-site validation);
- d. Administrative point of contact for the validation (provides financial and sales information).

The following is a typical and suggested schedule for a validation:

T - 90	Contact the Testing Laboratory, negotiate agreement, Validation Customer conducts self-testing
T - 60	Submit preliminary prevalidation materials and disputed tests, if any
T - 30	All prevalidation test materials received by the Testing Laboratory
T - 30	Resolve all outstanding issues
T	Testing begins (scheduled month)
T + 0-7	Testing complete
T + 10	Draft VSR available
T + 30	Final VSR available

(T represents the day testing begins and '-' or '+' integer represent the number of calendar days before or after the beginning testing day.)

13. Validation Issue and Withdrawn Tests

If a Validation Customer finds prior to the formal witness testing phase a Validation Issue, he must send a Validation Customer Dispute to the Testing Laboratory which then forwards a copy to the CIO with associated rationale and detailed documentation before the validation testing to allow for a timely resolution of the Validation Issue.

If any test fails during validation testing, these failed test results will be listed as nonconformities in the VSR. If a determination is later made that a Validation Issue was in error, the VSR will be corrected and reissued and if necessary a Validation Certificate.

Withdrawn tests will be listed in the attachments to the VSRs for all validations conducted during the time a test is under dispute.

Tests that are determined to incorrectly test the standard will be withdrawn and will be listed as being Withdrawn in the VSR. These tests will remain on the Withdrawn List until the problems have been resolved. Resolution may be reached in the following manner:

- a) If the test in error can be corrected with the use of Temporary Fixes (TPs), it will be removed from the Withdrawn List when these TPs are included in a new issue of the TP document. If the TP is only to delete the test, the test will remain on the Withdrawn List until the test is corrected
- b) When a new version of the test suite is issued and the test has been corrected (not merely deleted), the test will be removed from the Withdrawn List.
- c) Tests that are submitted for interpretation will be removed from the Withdrawn List when an interpretation has been issued. If the interpretation finds that the test is in error and a correction has been identified, it will be corrected with a TP, if possible, and retained in the test suite. If the interpretation finds that the test is an incorrect test, it will be removed from the test suite. Otherwise, the test will be reinstated to the test suite, and the Validation Customer will be informed of the interpretation results.

14. Reimbursement to the Testing Laboratory

The validation of SDTS products is performed on a fee for service basis. The Validation Customer must arrange with the Testing Laboratory for payment.

15. Release of Validation Information

Until a VSR is finalized, the Validation Customer will answer all requests for information concerning validation of that Customer's product.

16. Publication and Proprietary Data

In general the CIO shall have the right to use all information gathered in the course of developing and administering a SDTS testing program for the purpose of conducting the Validation Customer requested testing, but the CIO shall not release such information publicly except when reporting on the results of testing.

The Validation Customer shall place a Proprietary notice on all information delivered to the CIO or Testing Laboratory that the Validation Customer asserts is proprietary. Any information designated as proprietary that is furnished to Testing Laboratory, shall be used by the Testing Laboratory only for the purpose of carrying out validations. Information designated as proprietary shall not be disclosed, copied, reproduced or otherwise made available in any

form to any other person, firm, corporation, partnership, association or other confederation without the consent of the Validation Customer. The Testing Laboratory will use its best efforts to protect information designated as proprietary from unauthorized disclosure.

Validation Summary Reports completed by the Testing Laboratory shall be made available to the public unless the Validation Customer formally (in a letter) requests that the results be withheld from the public. In no event, however, shall the name of the Validation Customer or any of its trademarks and trade names be used in CIO or Testing Laboratory publications without the Validation Customer's prior written consent.

CIO and Testing Laboratory and Validation Customer shall agree to confer and consult prior to the publication of data to assure that no Proprietary Data is released and that patent rights are not jeopardized. Prior to publishing a Validation Summary Report, the Validation Customer shall be offered an opportunity to review such proposed publication.

17. Retention of Validation Records

The records and information used in preparing the Validation Summary Report will be retained per the TMECC requirements, for example six (6) months after the completion of the on-site validation effort.

18. SDTS/TVP Conformance Test Materials

There are separate Conformance Test Materials for Decoders, Encoders, and Transfers.

18.1 SDTS/TVP Decoder Conformance Test Materials

- Test points -- listing of profile requirements, which can be tested in a conformance test of a SDTS/TVP decoders. Includes preliminary test procedure and description of Validation Customer questionnaire. See document named: **SDTS/TVP Test Points for Conformance Testing of TVP Decoders.**
- Test data sets -- 3 different data sets which Validation Customers will have to decode. See document named: **SDTS/TVP Decoder Data Set Test Log.**
- Test script -- description of procedure used to validate encoders. See document named: **SDTS/TVP Decoder Conformance Test Script.**
- Request for Validation form -- questionnaire filled out by the Validation Customer requesting validation; provides information on the decoder provided for validation. See document named: **SDTS/TVP Decoder Request for Validation.**
- Validation Summary -- form used by Testing Laboratory to summarize validation of decoder. See document named: **SDTS/TVP Decoder Validation Summary.**

18.2 SDTS/TVP Encoder Conformance Test Materials

- TESTTVP -- validation software which reads an SDTS/TVP transfer and validates it against profile, SDTS, and ISO 8211 requirements. Runs on a UNIX workstation platform. Output report file summarizes problems detected in SDTS transfer. (Same software as for transfer conformance test.)
- Test points -- listing of profile requirements, which can be tested in a conformance test of a SDTS/TVP encoders. Includes preliminary test procedure and description of Validation Customer questionnaire. See document named: **SDTS/TVP Test Points for Conformance Testing of SDTS/TVP Encoders.**

- Test script -- description of procedure used to validate encoders. See document named: **SDTS/TVP Encoder Conformance Test Script.**
- Request for Validation form -- questionnaire filled out by the Validation Customer requesting validation; provides information on the encoder provided for validation. See document named: **SDTS/TVP Encoder Request for Validation.**
- Data Set Information form -- questionnaire filled out by the Validation Customer for each data set demonstrated (the Validation Customer is required to demonstrate the encoding of at least 3 transfers.). See document named: **SDTS/TVP Encoder Data Set Information.**
- Data Set Test Log -- form used by Validation Customer to log validation of one data set. See document named: **SDTS/TVP Encoder Data Test Log.**
- Validation Summary -- form used by Testing Laboratory to summarize validation of encoder. See document named: **SDTS/TVP Encoder Validation Summary.**

18.3 SDTS/TVP Transfer Conformance Test Materials

- TESTTVP -- validation software which reads an SDTS/TVP transfer and validates it against profile, SDTS, and ISO 8211 requirements. Runs on UNIX workstation platform. Output report file summarizes problems detected in SDTS transfer. Readme file and sample output attached
- Test points -- listing of profile requirements, which can be tested in a conformance test of a SDTS/TVP transfer. Most of these have been implemented via the TESTTVP software; a few require manual inspection of the data. See document named: **SDTS/TVP Test Points for Conformance Testing of TVP Transfer.**
- Test script -- description of procedure used to validate transfer. See document named: **SDTS/TVP Transfer Conformance Test Script.**
- Request for Validation form -- form filled out by the Validation Customer requesting validation; provides information on the data sets provided for validation. See document named: **SDTS/TVP Transfer Request for Validation.**
- Test log -- form used by Testing Laboratory to log validation of one transfer. See document named: **SDTS/TVP Transfer Test Log.**
- Validation Summary -- form used by Testing Laboratory to summarize validation of encoder. See document named: **SDTS/TVP Transfer Validation Summary.**

18.4 SDTS/TVP Test Suite

The SDTS/TVP Test Suite is available from the USGS recognized Testing Laboratory. See Item 4 above.

Appendix A
Validation Customer Dispute Format

[Part A]

Validation Customer:
Configuration:
SDTS/TVP Version:
Pre-Validation Submittal Date:

[Part A will be completed once by each Validation Customer; Part B will be completed for each dispute. It is not necessary for a pre-validation date to have been established. Part A information is treated as confidential. Submit both Part A and Part B to your Testing Laboratory. The Testing Laboratory will forward only Part B to the Certificate Issuing Organization for formal review and resolution.]

[Part B]

Reference: <test name (,test name)>
Summary: <brief description of the dispute>
Discussion: <detailed description of the dispute>

In this Discussion, arguments should be specified using test line #s and references to pertinent sections of the SDTS/TVP Standard. The Validation Customer must describe the behavior of the implementation for the test or tests that are disputed, stating the particular test messages that are produced. It is sufficient for the detailed description to be limited to the particular segment of test code that is disputed. Relevant source code with warning or error messages should be included. For a group of tests that cause essentially the same behavior, it is sufficient for a detailed description to be given for one of them, with the relevant line numbers given for the like problems in the related tests.

Failure to fully specify the points pertinent to a dispute might result in an adverse decision being made, with the disputer having to further argue the case with a second submittal to the CIO or Testing Laboratory.

Appendix B
Sample Validation Customer Declaration of Conformance

Validation Customer:

Certificate Awardee:

SDTS/TVP Certificate Issuing Organization:

SDTS/TVP Version:

[Select as appropriate

SDTS Decoder Implementation Name and Version:

SDTS Encoder Implementation Name and Version:

SDTS Transfer Identification:]

Computer Hardware Environment:

Computer Software Environment:

Declaration:

I, the undersigned, declare that my organization has no knowledge of deliberate deviations from the SDTS/TVP (FIPS 173) other than the omission of features as documented in the Validation Summary Report.

Validation Customer Signature: _____ Date:

Company:

Title:

Certificate Awardee Signature: _____ Date:

Company:

Title:

Appendix C
Sample Validation Certificate Format

Validation Certificate

Validation Customer:

Certificate Awardee:

Validation Certificate (VC) Number: [CIO-YYYY-MM-DD-nnnn; where CIO => initials of CIO; YYYY-MM-DD=> year-month-day validation effort completed; nnnn => CIO unique count incremented by 1 for each VC]

Validation Summary Report (VSR) Number: [unique CIO-project number]

VC Issue Date:

VC Expiration Date:

SDTS/TVP Certificate Issuing Organization:

SDTS/TVP Version:

[Select as appropriate

SDTS Decoder Implementation Name and Version:

SDTS Encoder Implementation Name and Version:

SDTS Transfer Identification:]

Computer Hardware Environment:

Computer Software Environment:

[Use as appropriate

Interoperability: (describe products and testing environment)]

CIO Signature:

Typed CIO Signature Name:

Date:

